Metals (2014)

Leon County's NPDES program requires trace element analysis monitoring for several stations throughout the County. Staff decided in 2012 to expand the trace element program to include all sampling locations to more accurately evaluate the County's watersheds. Trace elements naturally occur in very small amounts (few parts per million or less) in a given system. While a small amount of these elements are sometimes required for animal or plant life, many can be toxic at elevated levels **(Table 1)**.

TABLE 1. Trace elements sampled for by Leon County.

Element	Anthropogenic Sources	Effects and Significance
Arsenic	Alloys, pesticides, wood preservative semiconductors	Toxic, possibly carcinogenic
Boron	Coal, detergents, used to make types of glass and ceramics	Essential trace element, toxic at higher levels, especially to arthropods, used to track sewer line and septic tank failures
Cadmium	Industrial discharge, mining waste, metal plating, plumbing, manufacture of phosphate fertilizers	Toxic to aquatic biota, carcinogenic to humans, kidney is critical target organ
Copper	Alloys, metal plating, electrical wiring, plumbing, automotive brake pads, mining, pesticides, roofs, gutters, flashing and other architectural elements	Essential trace element, toxic to vascular plants and algae at higher levels
Lead	Fuel additive, paint, bullets and shots (ammunition), fishing weights, lead acid batteries	Toxicity (anemia, kidney disease, nervous system), harmful to wildlife
Nickel	Alloys, electroplating, batteries, coins, industrial plumbing	Essential element in some animals, toxic at higher levels
Titanium	Alloys, used as a white pigment for toothpaste, soaps, makeup, paints, paper	Non-toxic, can be used to track sewer line and septic tank failures
Zinc	Galvanized metal surfaces, motor oil and hydraulic fluid, tire dust, industrial waste, wood preservatives, paints, plumbing, batteries, deodorants	Essential element in many metalloenzymes, aids in wound healing, toxic to plants at higher levels

Toxic effects of heavy metals on freshwater organisms are related to water hardness (concentration of Ca^{2+} and Mg^{2+}). A higher total hardness level prevents fish from absorbing metals such as lead, arsenic and cadmium into their bloodstream through their gills. Because of this, state water quality limits for heavy metals are partially derived from total hardness concentrations. The naturally acidic (i.e. low hardness) conditions of most Leon County streams and lakes means that a given amount of heavy metal is more toxic and that water quality limits are correspondingly lower.

Most Leon County soils have a low sorption capacity for metal ions due to high sand content, low pH and low organic material. These characteristics often result in metals being relatively mobile in the environment; meaning that metals can readily and sometimes continually disperse downstream and downwind of their sources.

The above factors are reflected by the several lakes and streams with trace element levels exceeding Class III water quality standards in 2014 (**Table 2**). The elements that exceeded Class III water quality standards include lead (11 stations) and cadmium (two stations). These exceedances are thought to be caused by relict anthropogenic sources combined with enhanced metal mobility due to the naturally acidic soil and water conditions commonly found in Leon County.

Bradford Chain of Lakes

Elevated lead levels in Lakes Bradford, Hiawatha and Cascade are thought to be due to both relict and potentially current sources. Relict anthropogenic sources of lead in the area include a former shooting range and the former Dale Mabry airfield, while possible current sources include the Tallahassee Regional Airport (aviation fuel). The acidic nature of these lakes causes increased lead due to the enhanced solubility of lead under low pH conditions. Because acidic systems like the Bradford Chain of Lakes are more sensitive to metals contamination, exceedance levels tend to be lower and oftentimes more frequent than a similar metal level in a more alkaline system.

East Black Creek

The East Black Creek site located at Capitola and Heartside lead levels exceeded Class III water quality criteria during the 2nd quarter of 2014. Prior to sampling, the area received 3.84 inches of rain that possibly allowed lead contaminated runoff to enter the creek.

Louvinia Creek

Louvinia Creek lead levels exceeded Class III water quality criteria during the 1st quarter. Due to the natural soil characteristics of these watersheds, lead from relict anthropogenic sources can migrate relatively easily through the soil, leaching into the surface waters. These surface waters are more susceptible to even low levels of lead due to lead's bioavailability at the stream's normally low pH levels.

Lower Lake Lafayette

Cadmium levels exceeded Class III water quality criteria during the 1st quarter at station LLL12 (lower Lake Lafayette South side). The source(s) of cadmium are unknown at this time.

Lake McBride

Cadmium levels exceeded Class III water quality criteria during the 1st quarter at station MB6 (west Lake McBride). The source(s) of cadmium are unknown at this time.

Lake Munson and Munson Slough

Both Munson Slough and Lake Munson exceeded Class III water quality criteria for lead several times in 2014. Relict anthropogenic sources such as leaded gasoline are most likely to be the cause of these exceedances.

TABLE 2. Trace elements exceeding Class III water quality criteria in Leon County lakes and streams.

Description	Station Number	Metal of Concern	Results µg/L	Criterion µg/L	Calendar Qtr. Exceeded*
Bradford Chain of Lakes					
Lake Bradford	B0B	Lead	1.40, 1.20	0.54	1, 4
Lake Hiawatha	B0H	Lead	1.10	0.54	1
Lake Cascade	B0C	Lead	1.00, 1.10	0.54	1, 4
East Black Creek					
East Black Creek at Capitola and Heartside	BC4	Lead	1.40	0.54	2
Louvinia Creek					
Louvinia Creek at WW Kelley	LC @ WW Kelley	Lead	0.87	0.54	1
Lower Lake Lafayette					
Lower Lake Lafayette South Side	LLL12	Cadmium	0.28	0.10	1
Lake McBride					
West McBride	MB6	Cadmium	0.29	0.10	1
Lake Munson					
Lake Munson 2	LMU7	Lead	1.2, 1.1	0.72, 1.09	1, 4
Lake Munson 1	LMU8	Lead	0.88	0.75	1
Munson Slough					
Munson Slough above Lake Munson	MS1	Lead	1.4, 1.6	0.75, 1.18	1, 3, 4
Munson Slough below dam	MS2	Lead	0.91	0.72	1
Munson Slough on Forest Road	MS4	Lead	0.85, 1.0	0.72, 0.95	1, 4
Munson Slough at Oak Ridge Road	MS5	Lead	0.89, 2.1, 1.5	0.72, 0.87, 0.92	1, 2, 4

*1-1st quarter, 2-2nd quarter, 3-3rd quarter, 4-4th quarter